

WORKSHOP: STATISTICS – INTRODUCING SPSS IN ONE HOUR

for Semester Two, 2015



Stats at SLS

Student Learning offers workshops and one-to-one/small group assistance for undergraduate students wanting to improve their statistics skills and understanding of core concepts and topics.

Leila's website for Student Learning Statistics workshop hand-outs & information is here: <u>www.tinyURL.com/stats-SLS</u>

Resources for this workshop, including a pdf version of this hand-out and Leila's data files for each problem are available here: <u>www.tinyURL.com/stats-IS</u>

Please log in and go here '

Students **MUST REGISTER** for <u>each workshop</u> with **Student Learning**



Student Learning free services

Topics we teach in our workshops and provide one-to-one advice on include:

- ✓ Computer skills
- ✓ Strategies for succeeding at uni
- ✓ Learning effectively
- ✓ Thinking critically
- ✓ Reading effectively
- ✓ Note-taking
- ✓ Test and Exam skills:
 - Preparing and revising
 - Answering multi-choice, essay, and short answer questions
- ✓ Mathematics

- **Statistics**
- Writing skills including:
 - Paraphrasing, summarising, and quoting
 - Sentence and paragraph writing
 - o Editing and punctuation
 - Essay writing (analysing the question, planning, introductions, conclusions)
 - o **Referencing**

• Te Fale Pouāwhina (TFP) – for Māori and Pasifika students

Te Fale Pouāwhina (TFP) provides a friendly and professional service based on kaupapa Māori and Pacific principles. Māori and Pacific Learning Advisers are passionate about Māori and Pacific student success. The focus is on academic skills development at both undergraduate and postgraduate levels. TFP Learning Advisers work with a range of Māori and Pacific services across the University. Face-to-face learning options include workshops, study groups, wānanga/fono and advisory sessions. Contact Matt Tarawa or Mona O'Shea, or go to <u>www.tinyURL.com/SLS-TFP</u>

Learning disabilities students

Learning assessments are available for students with specific learning disabilities; academic assistance is available for these students and those with mental health impairments.

If you have any special learning requirements, please feel free to discuss this with Leila in person or via email or contact Student Learning Reception directly by phone on 373-7599 ext. 88850 or email <u>sls@auckland.ac.nz</u>. More information is available here: <u>tinyURL.com/SLS-LDS</u>

• English Language Enrichment (ELE) Language Learning Groups

Improve your English with 'Let's talk!' Meet with other students and an ELE Learning Adviser and talk about things that you want to talk about. No need to enrol. Just come. Mondays and Wednesdays 11-12 and Fridays 3-4 at ELE (Room 101, Level One, Info Commons Building). More information is available here: <u>tinyURL.com/SLS-ELE</u>

Language Exchange (LEX)

LEX is a non-credit activity at the University of Auckland. It gives you the opportunity to develop a language you want to learn or improve and helps other students to develop a language they are learning. All LEX participants are volunteers and the programme is free. More information is available here: <u>tinyURL.com/SLS-LEX</u>



Student Learning location and contact details

Student Learning Reception, City Campus, Room 315.320 (third floor, Kate Edgar Information Commons Building); 09-923 8850; <u>sls@auckland.ac.nz</u>; <u>www.library.auckland.ac.nz/student-learning</u>

Statistical help available from Leila Boyle at Student Learning

Each semester, Leila Boyle at Student Learning offers statistical help through a number of workshops and advisory sessions (either one-to-one or with study groups of two or more people) by appointment.

Student Learning Statistics Advisory Sessions

Book your preferred time with Leila here: <u>www.tinyurl.com/appt-stats</u>, or contact her directly:

Leila Boyle

Undergraduate Statistics Assistance at Student Learning Room 315.336 (third floor, Kate Edgar Information Commons Building) <u>I.boyle@auckland.ac.nz</u>; (09) 923-9045; 021 447-018

Student Learning Statistics Workshops

Workshops are run in a relaxed environment, and allow plenty of time for questions. In fact, this is encouraged

Please make sure you bring your calculator with you to all of these workshops. Either a scientific calculator or a graphics calculator is fine - it should be able to calculate the mean and standard deviation of a set of data.

• Preparation at the beginning of the semester:

A couple of preparation workshops are run at the beginning of the semester to get students off to a good start. There are multiple identical sessions of these one-hour long on weekdays over Weeks 1 to 3 of the semester – enrol in whichever one suits your schedule.

 $_{\odot}\,$ Basic maths and calculator skills for Statistics

www.tinyURL.com/stats-BM

Finding the sample mean and standard deviation (using a scientific or graphics calculator)
 <u>www.tinyurl.com/stats-FS</u>

• First half of the semester

Five theory workshops and one computing workshop are during the first half of the semester:

• Polls, Surveys, Experiments and Observational Studies

www.tinyURL.com/stats-PS

- Basic Data Analysis
 <u>www.tinyURL.com.com/stats-BDA</u>
- Proportions and Probabilities

www.tinyURL.com/stats-PP



• Confidence Intervals: *Proportions*

www.tinyURL.com/stats-CIP

www.tinyURL.com/stats-CIM

- Confidence Intervals: *Means*
- Computer Workshop: Introducing SPSS in One Hour

www.tinyURL.com/stats-IS

Second half of the semester

Four theory workshops and one computing workshop are during the second half of the semester:

• Statistics Theory Workshops

0	Hypothesis Tests: Proportions	www.tinyURL.com/stats-HTP
0	Hypothesis Tests: Means and medians	www.tinyURL.com/stats-HTM
0	Chi-Square Tests	www.tinyURL.com/stats-CST
0	Regression and Correlation	www.tinyURL.com/stats-RC
0	Computer Workshop: Hypothesis Tes	ts: SPSS (Means and Medians) in

 Computer Workshop: Hypothesis Tests: SPSS (Means and Medians) in One Hour
 www.tinyURL.com/stats-HTS

Please enrol in each of your preferred workshops at the Student Learning by either:

 Going online at: <u>www.library.auckland.ac.nz/booking</u> (search for Leila)

OR

Going to Student Learning in person (3rd floor, Kate Edgar Information Commons Building, corner of Alfred and Symonds Streets)

Useful Websites

- Student Learning webpage: <u>www.library.auckland.ac.nz/student-learning</u>
- For online workshop enrolment go to <u>www.library.auckland.ac.nz/booking</u>
 - Click on Undergraduate workshops, and Refine your results by clicking on appropriate Topics
 - For statistics workshops, *Search workshops* by *statistics*.
- Cecil: <u>https://cecil.auckland.ac.nz</u>
- Leila's website for Student Learning Statistics workshop hand-outs and information: <u>www.tinyURL.com/stats-SLS</u>



Basic Data Analysis

Want to check you understand this material and do some practice questions? **Find out more** at the *Basic Data Analysis* workshop, held in the <u>first</u> half of the semester.



Useful reference: Chance Encounters, pages 40 – 42

Displaying/graphing your data

Common displays of data include tables and graphs such as dotplots, stemand-leaf plots, boxplots, histograms and bar charts. Choosing which of these to use will depend on the type of variable/s you have collected and the relationships you are attempting to explore.



Displaying continuous quantitative variables Display tools:

- Appropriate plots for continuous quantitative variables are:
 - Dot plot small data sets, $n \leq 20$
 - Stem-and-leaf plot moderate data sets, $15 \le n \le 150$
 - Box plot moderate to large data sets, n ≥ 20
 - Histogram large data sets, n ≥ 50
- Features to look for and comment on in the above plots are:
 - Centre and spread
 - Modality How many modes/peaks does the data have?



Symmetry or skewness – Is the data symmetric or skewed?



- Outliers:
 - Are observations which are far from the bulk of the data



- Search for a reason for their existence
- Only delete outliers if they are found to be mistakes
- SPSS can identify outliers for you!
- Abrupt changes:



Useful reference: Chance Encounters, pages 58 – 60







SPSS Basics

You can use SPSS to plot data and perform simple calculations.

Opening a File in SPSS

1.

To create a new Data file in SPSS



OR

2. Click the **Open data document** icon on the SPSS **Data Editor Toolbar**.



To open an existing file in SPSS

1. Data file: click File \rightarrow Open \rightarrow Data. Output file: click File \rightarrow Open \rightarrow Output.

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Choose the file.
 Find and click the required file and click **Open**.



Importing data from an Excel file

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 Choose the file type.
 In the Files of Type box, choose Excel (*.xls).



3. Choose the file. Find and click the required file and click **Open**.



4. Click **Continue/OK**.

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Read variable names from the first row of data
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Continue Cancel Help



Saving

In SPSS, data and output are saved separately.

1. Click **File** \rightarrow **Save**.

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2. Enter the file name.

Type a name for the file in the **File name** box and click **Save**.

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What can we see in the SPSS Data Editor?



In SPSS, there are two different views, the **Data View** and the **Variable View**. The **Data View** and the **Variable View** are two interlinked representations of the data contained in SPSS's **Data Editor**. You can switch between these views by clicking on the tabs with these names at the bottom

left of SPSS's **Data Editor** window; whichever tab is orange is the view currently on the screen.



Data View

To view the data view, click the **Data View** tab at the bottom of the window.

All data is entered in the data view. Each row corresponds to one case (an individual, an experimental unit, etc.), and each column is a variable.

You can also view labels in the data view.

To view variable labels, hold the mouse over the variable names at the top of each column. The variable label will appear.

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To view value labels, click the **Value Labels** button . The labels will now appear instead of the values. You can see all of the labels available for any variable by triple clicking on the right side of any cell in that variable's column.

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1	14	5.0	00	4.00	4.00	3	00	4.00	4.00	5.00	Study related work	
1	15	4.0	00	5.00	5.00	4	00	4.00	4.00	5.00	Watch TV	
1	16	2.0	00	2.00	3.00	4	00	4.00	4.00	6.00	Nothing	
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Variable View

To view the variable view, click the **Variable View** tab at the bottom of the window.

Variables are created in the **Variable View** window. Each row corresponds to one variable, and the columns contain information about each variable.

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Name

This column contains the name of each variable. To enter the name, click in the cell and type the variable name.

Variable names are abbreviations of what the variable is. There is, the name must start with an upper or lowercase letter and may include any combination of letters, numbers and underscores but no other characters are allowed.

There are rules that govern what we can actually call a variable:

- Each variable name must be unique; duplication is not allowed.
- Variable names must begin with a letter (upper or lower case) or an at sign (@).



- Variable names cannot end with a full stop.
- Variable names cannot contain spaces.
- Depending on the language you are using, variable names cannot exceed 64 characters (in English, French, German, Spanish, Italian, Hebrew, Russian, Greek, Arabic, and Thai, for example) or 32 characters (in Japanese, Chinese, and Korean, for example).
- Variable names may include letters (upper or lower case), numbers and some other characters such as the full stop (.), the at sign (@), the hashtag (#), the dollar sign (\$) or the underscore (_). For example, A._\$@#1 is a valid (but not particularly meaningful) variable name!
- Reserved keywords cannot be used as variable names: ALL, AND, BY, EQ, GE, GT, LE, LT, NE, NOT, OR, TO, WITH.

Don't bother to learn these rules – SPSS will let you know with an error message if you break one!



Often people truncate or abbreviate variable names and assign a **Label** which gives a more detailed description of the variable (including units, if appropriate) and/or a more meaningful name.

Туре

This contains the type of the variable – usually Numeric. When entering qualitative data, you should always use the Numeric type. You can then use numbers (e.g. enter 1, 2, 3, ... as codes) when entering data and use the value labels in the **Value** column to make them more meaningful.

If you want to change the type, click in the cell and then click .

Choose the type and click **OK**.



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Width

If the variable is of type String, this represents the maximum number of characters the string can contain. You should make sure this is high enough to allow all of your data to be entered correctly.

To enter the width of the string, click in the cell and type the width.

Decimals

If the variable is of type Numeric, this represents the number of decimal places the variable can contain.

To enter the number of decimal places, click in the cell and type the number.

Label

Variable labels are used to give a more meaningful description of the variable than the variable name. Understanding the computer output is made easier by using variable labels. They can be up to 256 characters long, and any characters, including spaces, are allowed.

To enter a label, click in the cell and type the label.

Values

Value labels are used to give more meaningful descriptions of the numerical values used for qualitative (grouping/categorical) data.

For example, in our dataset, we have allocated the codes 1 and 2 for the two different levels of the gender group. Understanding the 1s and 2s in the computer output is made easier by using value labels.



They can be of any length, and spaces and all other characters are allowed.

To enter value labels, click in the cell and then click .

In the **Value** box, type one of the values that your variable takes.

In the **Value Label** box, type the label that you want that value to have.

Click **Add**.

Repeat this process for all values. Then click **OK**.

ta Value Labels	×	Value Labels	X
Value Labels Value: 1 Label: Male Change Remove OK Cancel Help	Spelling	Value Labels Value: Label: Add Change Remove OK Cancel Help	Spelling



It is also possible to enter actual words i.e. **String** variables into SPSS, but if we entered **Male** and **Female** in this way we would not be able to use them in statistical analyses. If you do wish to enter words as part of your data set however, in the **Variable View**, in the **Type** column for your variable, click on the box with the three dots that appears, and change to **String**, then click the **OK** button.

Entering data

1. Set up the variables in the **Variable View**.

Click **Variable View**. Enter each variable that you will be using.

2. Type in the data in the **Data View**.

Click **Data View**. Enter all the data.



It is good practice to assign a unique identifier to each subject. This will help you find each individual quickly and easily if you find you have any data entry mistakes or if they are identified as an outlier.



Generating Descriptive Statistics and Creating a Stem and Leaf Plot and a Box Plot in SPSS

Example: Generate descriptive statistics and create a stem-and-leaf plot and a box plot for the breaking strengths of gear teeth in certain positions of a gear.

1. Enter the data into SPSS

OR open the GearTeeth.sav file from www.tinyURL.com/stats-IS.

Label **strength** as **Breaking Strengths of Gear Teeth** in the **Variable View**.

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2. Choose the analysis tool: **Explore.** Click **Analyze** \rightarrow **Descriptive Statistics** \rightarrow **Explore**.

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	2	2275.00		Gene	ralized Linear Mode	ls 🕨	Cross	tabs				
	3	1946.00		Mixed	- Models	*	TURF	Analysis				
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	5	2228.00		Regr	ession		<u>Р</u> -Р Р	lots				
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	7	2000.00		Nour	al Natworks				_			
	8	2006.00		Neur	ar networks							
	9	1945.00		Class	siiy							



3. Select the relevant variable(s).

Quantitative variable(s) \rightarrow **Dependent List** box.

Click **Breaking Strengths of Gear Teeth [strength]**. Click the first . Then click **OK**.

Explore	X	Explore
Breaking Strengths Breaking Strengths Display Both O Statistics O Plots OK Paste R	2ependent List: Statistics Piots Options Bootstrap abel <u>Cases by:</u> eset Cancel Help	Dependent List Statistics Plots Options Bootstrap Display @ Both © Statistics © Plots OK Paste Reset Cancel Help

4. The results appear in the Output Window.

Explore

	Case Processing Summary								
Cases									
	Va	lid	Miss	sing	Total				
	N	Percent	N	Percent	N	Percent			
Breaking Strengths of Gear Teeth	33	100.0%	0	0.0%	33	100.0%			

	Descriptives			
			Statistic	Std. Error
Breaking Strengths of	Mean		2067.0303	31.01907
Gear Teeth	95% Confidence Interval	Lower Bound	2003.8465	
	tor Mean	Upper Bound	2130.2141	
	5% Trimmed Mean	2080.5253		
	Median	2120.0000		
	Variance	31752.030		
	Std. Deviation	178.19099		
	Minimum	1588.00		
	Maximum		2287.00	
	Range		699.00	
	Interquartile Range		249.00	
	Skewness		-1.152	.409
	Kurtosis		1.060	.798

Breaking Strengths of Gear Teeth

Breaking Strengths of Gear Teeth Stem-and-Leaf Plot

Frequency Stem & Leaf

1.00	Extremes	(=<1588)
2.00	16	49
.00	17	
.00	18	
7.00	19	0344566
5.00	20	00066
7.00	21	1225555
11.00	22	00111223678





Creating side-by-side boxplots in SPSS

Example: A random sample of 40 cellphones of the same make and model were chosen. Half of the cellphones were randomly selected to have a nickel-cadmium battery put in them and the rest had a nickel-metal hydride battery. The talk time (in minutes) before the batteries needed to be recharged was recorded.

1. Enter the data into SPSS

OR open the <u>Batteries.sav</u> file from <u>www.tinyURL.com/stats-IS</u>.

Use a value of **1** for **Cadmium** and **2** for **Metal Hydride**:

🔚 stat	tistics_b	atteries.s	av [DataS	et2] - IBM SP	SS Statistics	Data Editor						
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- 2	2]	1	102.70								
1	3]	1	89.20								
4	4]	1	93.00								
	5		1	99.20								
(6]	1	83.60								
1	7		1	105.30								
8	8]	1	88.90								
9	Э]	1	88.20								
1	0		1	72.10								
1	1]	1	80.60								
1	2		1	89.10								
1	3]	1	78.00								
1	4		1	95.40								
1	5		1	92.40								
1	6]	1	102.30								
1	7		1	97.00								
1	8		1	88.30								
1	9		1	67.70								
2	0		1	98.70								
2	1		2	66.80								
2	2		2	73.00								
2	3		2	91.30								
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Assign labels.
 Label the values:
 Label 1 as Cadmium and 2 as Metal Hydride.

Value Labels	X
_Value Labels	
Value: 2	Spelling
Label: Metal Hydride	
1 = "Cadmium"	
Add 2 = "Metal Hydride"	
(<u>C</u> hange	
Remove	
OK Cancel Help	



- 3. Plot the data using a boxplot.
 - a. Choose the **Explore** tool: Click **Analyze** \rightarrow **Descriptive Statistics** \rightarrow **Explore**

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4			1	93.00	Correlate	•	Ratio.					
5			1	99.20	Regression	•	<u>р</u> -Р Р	lots				
6			1	83.60	L <u>o</u> glinear	•	🛃 <u>Q</u> -Q P	lots				
7			1	105.30	Neural Networks	•			-			
8			1	88.90	Classify	•						
9	9 1 88.20		Dimension Reduction	*								
10			1	72.10	Scale	*			_			
11			1	80.60	- Nonparametric Tests	*						
12			1	89.10	Forecasting	*						
13			1	78.00	Survival	*						
14			1	95.40	– Multiple Response	*						
10			1	102.40	Missing Value Analysis							
17			1	97.00	Multiple Imputation	*						
18			1	88.30	Complex Samples	*						
19			1	67.70	Simulation							
20			1	98.70	Quality Control							
21			2	66.80								
22			2	73.00								
23			2	91.30	IBM SPSS Amos							-
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b. Assign the variables.

Quantitative (response) variable \rightarrow **Dependent List** box. Click **Time**.

Click 🖻.

Qualitative variable (grouping factor) \rightarrow **Factor List** box. Click **Battery**. Click **S**.

Explore	Explore
▲ Battery Dependent List Statistics ✓ Time Factor List: Dottons ▲ Dependent List Bootstrap ▲ Label Cases by: Label Cases by:	Dependent List: Statistics Image: Constraint of the state of the
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OK Paste Reset Cancel Help	OK Paste Reset Cancel Help



c. View and interpret the boxplots.



Creating a Scatter Plot in SPSS

Example: Create a scatter-plot of the female coyote length and weight data.

1. Enter the data into SPSS

OR import <u>Length and Weight Data.xls</u> into SPSS after saving it from <u>www.tinyURL.com/stats-IS</u>

OR copy the numerical values from *Excel* to SPSS and enter the variable names **Length** and **Weight** in the **Variable View**.





Choose the graph type.

Click **Graphs** \rightarrow **Legacy Dialogs** \rightarrow **Scatter/Dot**.

Contitled?	[DataSet3] - IBM	SPSS Statistics	Data Editor							×
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Click **Simple Scatter**. Click **Define**.



2. Select the relevant variables.

Dependent variable \rightarrow **Y** Axis box. Click Length. Click the first \square .

Independent variable \rightarrow **X Axis** box. Click **Weight**. Click the second S.

Simple Scatterplot		×	Simple Scatterplot		×
	YAxis: XAxis: Set Markers by: Label Cases by:	 Options		Y Axis: X Axis: Weight Set Markers by: Label Cases by:	<u>Titles</u> Options

3. Enter titles.

Click Titles.

Type **Scatterplot of Length versus Weight** in the **Title Line 1** box. Click **Continue**. Then click **OK**.

ta Titles	×
Title	
<u>L</u> ine 1:	Scatterplot of Length versus Weight for Female Coyotes
Li <u>n</u> e 2:	
Subtitle:	
Footnote	
Line <u>1</u> :	
Line <u>2</u> :	
	Continue Cancel Help



4. The graph appears in the Output Window.



- 5. To add a trend line to the scatterplot:
 - a. Double click on your plot. Click on "Add Fit Line At Total".





b. Choose the line which gets R² closest to 1 (either Quadratic or Cubic in this case) by clicking on your choice and then clicking Apply.







c. Delete any elements you don't want. Uncheck the box next to "Attach label to line" and click **Apply**.



d. Delete any elements you don't want. Click on the R^2 statement and press the **Delete** key then close the graph editor.

